Addis Ababa Science and Technology University

Typical Designs and their effect in the construction phase- The case of Mizan-Tepi University

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By

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List of Abbreviations

AASHTO—American Association of State Highway and Transportation Officials

ADB—African Development Bank

ADF—African Development Fund

ASCE—American Society of Civil Engineers

CRFD—Cedar Rapids Fire Department

ESBU—Elementary School Building unit

GDP—Gross Domestic Product

GTZ IS –Deutsche Gesellschaft fur TechnischeZusammenarbeit

HVAC—Heating,Ventilation and Air Conditioning

MoE—Ministry of Education

MTU—Mizan –Teppi University

NEHRP –National Earthquake Hazards Reduction Program

Sida—Swedish International Development Agency

Abstract

The construction industry is suffering in different forms of problems though its contribution for the GDP of countries is still significant. This is because the first and the most important phase that needs attention is usually overviewed much attention being given to the construction phase. But, the major problems that arise in the construction are related to and are the result of the design phase omissions and negligence.

Poor feasibility, incomplete designs, poor geotechnical investigations are few among the most important design consideration for a given design what so ever building, road or dam. Irrespective of these site specific considerations ,many owners prefer the typical designs than the premium, for mere reason of less design fee, ease of project monitoring and controlling .The Ministry of Education is on to be noted for the implementation of typical designs that it was building in the 13 universities located in different regions of the country. It may seem simple at the beginning to implement typical designs at the beginning ,but experience has shown that ,typical designs those seems to cost less ,are finally costly and time taking.

The construction projects in Mizan-Teppi University are one among the thirteen University typical designs. Hence, the history of the construction process was not only the history of delay, termination and ultimate dispute was also a question of end users and victim contractors. The program though designed as a means to build the capacity of contractors was not as assumed, and hence many contractors were victim of termination which are the problems related to additional costs and time,all the result of the typical designs. Whenever, designs are done by due consideration of the prevailing design parameters there will be few or no variation works, resulting in no few claims for time and cost on the side of the contractor.

As per the agreement to design typical designs, MH consulting Engineers who was in charge of the design and supervision, designed all the 13 Universities, which are similar from the sub to the super structure for all .GTZ IS being the full delegate of the Ministry of Education, was in charge of nominating and signing contracts with the contractor, supplying materials and effecting payments. The investigation proved that, all these arrangements end up in failure due to the problem of typical designs and supervision related reasons. Mizan-Teppi University is on case of such failures. Out of the total five contractors who were in Mizan-teppi University, all of them

end up in failure, all being terminated non amicably. This is not the failure of the issue of the five contractors but the failure of the program to implement typical designs. The causes of delay and the ultimate termination, was all related to the designs which are not prepared for the specific design. The residual effect of delay and termination of such projects is still visible in the Mizan - Teppi University, as a reflection of reworks, demolition and alterations to make the buildings user friendly and in harmony with the prevailing climatic condition

Chapter One

Introduction

The economic development level is measured in different ways. The type, size,number and complexity of buildings is one good indicators of the economic development of a given country. Hence many countries give attention to this industry as a reflection to their economy development and for its contribution to the GDP of their country. The employment opportunity that the construction industry creates is the other significant focus of countries in the Construction sector.

Many literatures are written the contribution of this industry as well as the problems it is facing .The same is written for design issue of construction projects.

But, in case of our country, there is no much written literature regarding the problems of projects in the design as well as the construction phase. Regarding the effects of typical designs of on contract administration of contracting parties, there nothing found to the knowledge and effort of this researcher.

Currently university building construction projects are built in different regions of the country are contributing much to the employment opportunity during construction and operation ,in addition to contributing in increasing the number of University graduates .It is not only the construction of new universities in new locations ,but also the expansion projects in those pioneer universities that are contributing to the aforementioned results .It is of course unfortunate that most of them are suffering in completing the projects as scheduled. The problem behind those new generation Universities is related to typical designs and the supervision of projects more as a consequential effect of the typical designs.

Hence, this short paper focuses on the effects of typical design effect in contract administration in the construction phase, taking the case of Mizan –Teppi University. Mizan –Teppi University is one of the 13 Universities that much suffered in the construction phase of the typical designs. It also focuses on the effect of typical designs on the relation between contracting parties as well the subsequent effect and outcome on contracting parties

Objective of the study

This study has the following objectives

1) To assess the effects of typical designs in the Construction phase of Mizan-Teppi University
2) To investigate the effect of typical designs in the contract administration/construction phase/ of Mizan-Teppi Universities
3) To recommend the possible solution that can minimize the drawbacks of typical designs in the construction phase.

Scope of the Study

This short paper has limited in its scope mainly because ,it would have been better and complete had it been a comparative study ,taking two or three other universities at which the typical designs are applied ,and accordingly compare the effect of these typical designs. Hence, it has limitation as it lacks comparative effect of the typical designs in other universities. The other limitation, is the countless attempt of the researcher to get data from the then consulting Engineer was not fruitful, hence ones again have limitation as it does not include the idea of the Consultant.

Statement of the Problem

The construction industry in general and building construction in particular is suffering in different design related problems. Being known for its contribution for the national GDP for the job opportunity it create,should be given attention. Design related problems, especially those of typical designs are of serious construction phase problem cases. It is due to this issue that this research paper is concerned in assessing the implementation of typical designs implementation taking the case of Mizan-Teppi as an Instance.

Methodology Of the study

The method used for this research paper is an interview method of data collection. Those to be interviewed are from the contractor and from MTU side. The samples is chosen from those that were in place of administering ,and those who have enough and sufficient information that research demands .The analysis is done on the basis of data collected. The method of data analysis to be used will be a qualitative analysis as there were problems of handling documents for the quantitative figures may not be reliable

Chapter Two

Literature Review

2.1 What are typical Designs?

Before defining what typical designs are it is better to define the term design first. Hence building design (Wikipedia definition) refers to "The broadly based Architectural, Engineering and technical applications to the design of buildings."

Designs are classified in to two major categories as

i) Premium designs – these are portfolio designs which can (are) be used exclusively by premium members

ii) Typical designs - refers to those designs which can be used by free members.

Premium designs are usually superior in quality of designs and are also with high design fee. It is a specific design to be done for a specific location, it has no similar of exactly the same type.

On the other hand typical designs which are also called standard designs are, of low quality (relative to the premium) and are of typical in their nature, complexity and size. In most cases these are the type of buildings which are constructed in many number like the condominium and the low cast saving houses in our country.

Typical designs are thus, those designs which have the same structural &architectural designs and constructed in many numbers either in one or in different locations.

2.2 The History of typical Designs

Building construction have passed different steps before it reached to the today's advanced level. When looking from the history of construction in general, people have constructed buildings and other structures since pre-history, including bridges dams, rood and canals.

In the early beginning of human history, the materials that were used for building constructions were so poor in durability such as leaves, branches and animal hides,. Later, as time goes on in history, as people's awareness increased, they begin to use more durable materials like clay, stone, timbered.

And then, they began to use synthetic materials like brick, concrete, metals and plastics which are more durable of more than decades of years. The emergence of typical designs is

highly associated to the introduction of the use of these durable synthetic and manufactured materials. Meaning, as people see the durability of the buildings made from these synthetic and processed materials, they began to construct building of the same type in their design. Hence, the history of typical designs goes back to the beginning of the use of synthetic materials for building constructions. There for, there is no a clear cut off time for the beginning of the typical building in history.

2.3 History of Typical Designs in Ethiopia

The beginning of building design of modern times of Ethiopia usually went back to the reign of Emperor Haile Selassie. (sida, 2014)

As per the Sida Report,the first typical designs to be constructed in Ethiopia were primary schools under the ESUB (Elementary School Building Unit) Hence, it was in early 1970's to1980's that the building of primary schools with the help of Swedish volunteers and support started the ESBU package .It was at this time that 6000 typical Elementary Schools were built by the Swedish. Thus, the history of typical building constructions in Ethiopia is first launched by the Swedish. The materials were precast column and wall systems. It is after the Sida(Swedish International Development Cooperation Agency) ESBU program, that many other typical building like the health posts, health centers and Hospitals of different sizes were proceeded (sida, 2014)

The ease to supervise, to use skilled and semiskilled labors moving from one to the other site were the two prime motives to design and launch the construction of typically designed primary schools.

2.4 Types of Typical Designs in Ethiopia

Though most of the typical buildings are government buildings, there are many typical designs of private owned like the Real estate buildings and the cooperative housing association private houses. Most of the government typical buildings are almost targeted for social service, typically for education and health care service purpose.

Though, there are other types of typical building designs the following are the predominant typical government owned typical designs.

i) Educational Institutions

ii) Health care instantiations

Sida being pioneer in implementing typical designs at elementary school level in the Education sector and primary clinics in the health sector, both of the building being still strong, have reasons for the launching/implementation/ of typical designs (sida, 2014)

- Ease of Supervision and Construction/Ease Implementation/

It is true that, typical designs being same in every of their structure and architect it is simple to supervise. This is because, the quantity of materials consumed in one project will be the same in all the others. As there was no any form of procurement used at that time, and as it was an own force project, the advantage of typical designs over the premium ones is really significant. It is not only the ease of supervision that is the reason, but also the time of completion, the quality control are also the other basic issues behind the launching of typical designs.

The other basic reason was as the Swedish were not in direct involvement in the actual construction, and as there was shortage of skilled man power in the time, it was convenient and economical for the training of Forman and laborer's to involve mason or carpenter. At the same time, ones the skill laborer's are involved in one school construction, it was easy for them to do the same typical school in other location under less or almost no supervision.

In the same token, it was also convenient and economical to mobilize and use resources like hand tools and form works. The mass production of precast wall and column members of the building was the other to be mentioned in the choice behind typical designs.

- Easy control of the Budget

Except the substructure which is to be revised depending on the specific location, typical designs are same in their sub and super structure, hence simple to estimate the cost required for one primary school. It is obvious that controlling cost of construction is the major challenge behind own force project implementation method though it has other notable advantages over premium typical designs.

It seems that, in the Current situation, Sida seems totally replaced by GTZ IS construction in the Education sector .Hence as per GTZ IS, Educational institutions (universities) were typical in

their design for the following reasons.(Report on Project appraisal Report GTZ IS of the 13 University Projects)

1. Ease of implementation

It is easy, convenient and proved good to smoothly implement typical designs than premium ones. When universities were planned to belaunched it was fixed rate that was set, with some factor of multiplication to consider the local material inputs and labour cost as well as the distance of the site from the source of industrial materials differences.

The plan of implementation of these university buildings was mainly designed by GTZ IS-a German financed non-governmental organization. Accordingly though the standard design was done by a domestic consultant, the supervision was jointly done by the GTZ IS staffs and the consultant. It was simple for the ministry of supply the necessary cement and reinforcement bas, as the quantity is equal for all the Universities.

2) Ease of payment controlling

As the contract will be ad-measurement contract, payment to the contractors will be approved as per the quantity of the volume of work executed. Hence, though there will be some alterations in foundation design after the contract is signed and hence may result in corresponding change in quantity of work to be executed, the super structure for all the universities was all the same. This will highly help highly to control some unethical practices in the contract administration, and ultimately resulted in controlling cost over runs.

3) Fair share for regions

As typical designs are similar in all their features from the sub to the sub structure, then societies of different regions in the country, especially those of minorities will have a sense of belongingness and fair share in their countries economy when they observe a similar and same educational or health services institutions, are constructed in those major societies areas are built in their area. They will not develop sense of marginalization and ultimately will not be a cause for political instability.

4) Financer's Requirement

It was not only the higher institution buildings that were constructed on the basis of typical designs. It was also high schools and primary schools. Regarding high schools and primary

schools the reason for typical designs is not for the sake of controlling payments and ease of implementation, schools and primary schools, were usually financed by on soft and hard loans from Africa development found (ADF) and Africa Development bank (ADB) respectively.

Accordingly, these financing institutions set typical designs as a requirement to finance the projects. Thus, these institutions have approved and the ministry has agreed on, and different typical designs were implemented in different times in all regions of the country.(http:adb/project appraisal/procedure)

In similar manner, typical designs of health posts, health centers and Hospitals of different levels (primary, distinct, zonal referral) were implemented by the ministry of education for the same financing reason mentioned above.

2.5 Site adaptation and design revision

As typical designs are not prepared considering the special design parameters of specific location ,it is inevitable for site adaptation to be done .Site adaptation will solve the problems of typical designs at revises those to be revised on the basis of the specific design parameters .Site adaptation is always followed by design revision .

To what level of extent an Architect designs professionally designs a typical design, it is normal and inevitable to accordingly adapt to the specific location by revising the design, when implementing typical designs in different locations.

Site adaptation and design revisions are compulsory due to the following drawbacks of typical designs

1. It may not be best for a given specific locality.

It is obvious that, designs are always specific to a given locality. There are no two construction projects that are similar, at least three different in location. Therefore, as a procedure to site adaptation and geotechnical investigation for designs, typical designs over views these procedures and hence usually costs both time and money, as at is mandatory to revise designs.

2. It does not consider climatic factors of the specific location.

Climatic factors (Temperature, Rainfall, Wind) are one among the most important to be considered as a design factor consideration. This results not only an excess and unnecessary cost but also results in discomfort of end users. Obviously as the wall heights, openings for lighting and ventilation, the cooling and heating systems being the same, buildings of the same design built in different location, will not serve the purpose intended to. (Sarieh Zareaian, 2013)

In addition to the above two important elements of climate, wind speed, which also called wind load is important to be considered. Depending on the specific location and orientation of the building, wind has great effect on the structure of the building. Unlike temperature and rainfall which are usually related to comfort and aesthetes of buildings, wind is of great concern for structure of buildings. Wall systems of buildings should be specifically well designed for the safe and stable structure of buildings.

According to (Sarieh Zareaian, 2013) it highly considers the role of the various meteorological factors in construction including the intensity and amount of rainfall, temperature, humidity direction and wind speed, detriment of environmental phenomenon including heavy showers, heavy winds heavy snows, etc which are specific to a given locality.

3. High compromise for Aesthetics

Aesthetics is the other compromised issue regarding typical designs. The different views (the front being the most important to be considered for Aesthetics), depends on the specific topography and direct of wind. Hence, a typical design will no fit to all localities, to keep the expected Aesthetics. Hence, the orientation of the building will be on the basis of the prevailing wind direction (wind load), that high affects the design expectation of buildings.

2.6 Parameters of design in general

Design of any kind, as is true for buildings are based on some considerations (parameters). These parameters have great effect first and prime most on the stability of the structure, in addition to the cost of building. Therefore, when designing buildings, the designer will consider all the factors, according to their effect contribution, and organize and balance intuitively.

The following are the major factors of building design;

- Soil type /Geotechnical investigation, Geology of the Area)

- Climate
  - -Temperature
  - - Rainfall
  - - Wind
- Topography
- Resource availability
- Location of the project

2.6.1. Soil Type /Geotechnical investigation, Geology of the area)

Geotechnical investigation which ends up in conclusion and recommendation for foundation, is an important and mandatory agenda to be considered and passed through in the design process.

In Geotechnical investigation, the following listed information are provided

i) Information to determine the type of foundation required.

It is on this basis of information that, foundation either shallow or deep is determined. Without this information leaving alone, concluding the design process it is impossible to even start.

ii) Information to recommend the allowable bearing capacity of the soil.

It is the bearing capacity of the soil,that ultimately determines the safety and stability of the structure to be constructed. It means, the geotechnical investigation gives data for the geotechnical engineer to recommend as to the bearing capacity allowed.

iii) Information regarding the settlement and swelling prediction.

This investigation is valuable to determine the bulk excavation level, and the fill materials to be used. It means the sub soil for foundation should be stable neither to shrink nor to swell, in order for the building to be stable. It is due to the variable property of black cotton soil that, it is usually not a choice to engineers as an area of construction, as long as there are alternative, pool of options. This investigation also helps, not only to determine the depth of bulk excavation and type of backfill material, it also helps to think of alternative methods to stabilize the soil without excavation. This recommendation highly depends on which ever of the alternatives is economical

IV) Location of the ground water level

The level of the ground water is on important parameter for foundation design. Water in soils have great effect in changing the property of the foundation soil. Hence, as long as the ground water has effect on the property of the soil, and if the property of the soil in turn has consequential affect on the building stability, obviously ground water level is a crucial consideration for design of buildings.

Ground, water level not only have effect on foundation of buildings in affecting the property of the foundation sub soil, but also has great effect in imposing additional pressure which is an uplift pressure. The uplift pressure, which is one important load in design analysis is the consequence of ground water level.

V) Information regarding permeability and compaction properties of the encounter materials /laboratory test/

Permeability and compaction properties are directly related to the volume change of property of the soil, which means the density of the bearing soil. The density of the foundation soil is highly crucial for the bearing capacity of the foundation soil

Vi) Information for the identification and solution of excavation problems can be made

The type and property of soil has an impact on the excavation activity for foundation. Hard rock excavation soft rock and collapsible clay or black cotton soils will be excavated in the same Equipment and method. Hence, geotechnical investigation ones more have such contribution for design of foundations.

2.6.2. Climate

Climate consideration in building and urban design is hugely important. The building must be adoptive to the environment to create a comfortable living space. The physical comfort we feel in building is a result of the heating energy balance between the surrounding space and ourselves. It also further describes that, because of the intense heat in hot countries, solar gain and heat conduction into the building should be minimized while ventilation, evaporation, earth cooling and radiant cooling should be utilized

In the creative process of building design, a great deal of consideration is given to the physical landscape of a development. This task of optimizing the readily observable attributes of a plan to its physical landscape can be a daunting task further complicated by the analysis of additional unseen nonphysical factors. These factors often include the analysis or impact of radiant solar angels, sun shadows, noise, vibration wind force, an quality, pedestrian level winds, snow loading ,etc ((Mike Carter C.E.T and Roman Stangi, 2016)

Buildings are designed for a certain period of life time usually hundred years. There for, it is should not base only on the previous year's data of climate, but also it should consider the proper functioning of the building with in its lifetime, considering the effect of climate change as a result of global warning(The impact of climate change on the environmental design building.)

In this same technical note description, the successful design of buildings receives on an

Appropriate understanding of climate (Oreszezyn, 2010)

"Concrete structures are subjected, besides live and dead loads to seasonal daily temperature changes and consequently temperature loads as a result of their interaction with the surrounding environment and due to the exposure to solar location. Such temperature loadings consequently lead to thermal stress in most structural elements. This thermal stress can be comparable or even exceed in magnitude the stress induced by the live and dead loadings in case of no or/little thermal insulation and could dead to severe damage it not considered during the design phase. The effect of temperature as design consideration is further described as follows as follows (K.Ahmed, 2001)

Therefore, in reinforced concrete and steel structures as, change in temperature does not only affect the comfort of the inhabitants, but also have great effect in resulting in volume change, which intern have effect on the elastic modulus and stress, that ultimately have effect on the structure of the buildings

The external effect of climate on building have effect on the internal rooms of the buildings. Accordingly, technology is introduced to indoor thermal comfort and acceptable indoor air quality) It is called HVAC (Heating, Ventilation and Air Conditioning). HVAC is the process of exchanging or replacing air in only space to provide high indoor air quality which involves temperature control, oxygen replenishment, and removal of moisture, odors, smoke, heat, dust, air borne bacteria. Carbon dioxide and other gases. Ventilation removes unpleasant smells and

excessive moisture, introduces outside air, keeps interior building a circulating and prevents**.** (Oreszezyn, 2010) Hence, Climate which includes the temperature, rainfall wind, etc properties of a given area is another important parameter for foundation design consideration.

I. Rain fall

The role of climate factors on designing and construction buildings (from urbanization Architecture Approach), the amount of rain fall is one of the most determining factor that shall be considered in building design, especially the ceiling design. In areas where the amount of rain fall is high ceiling material should be chosen carefully in such a way that it should not be easily eroded and damage (Sarieh Zareaian, 2013)

In addition, the intensity of rainfall is the other factor that has effect on the scope of the truss of buildings and the material type that is going to be used.

11) Temperature

Temperature is classified in to two as the weather temperature and soil temperature (Sarieh Zareaian, 2013).

a) **Weather temperature**: - This refers to the atmospheric temperature that has effect to the exposed super structure surface of the building. This temperature has effect in determining the wall height, the openings type and quantity, the type of materials to be used as well the ventilation, heating and cooling electrical installation systems. Obviously, decision on choice of building materials for those buildings in tropical, temperate, frigid and arctic regions will no be the same.

b) Soil temperature

More than other areas, this factor of design is of great determining factor in glacial soils. It mean in glacial soils, there is a potential of freeze which results in volume change of soils, which in turn will affect the stability of the soil. Hence, knowing the depth of the glacial soil (soil temperature), will be important to design the foundation in such a way that, it will be remedied and proactively protected.

111) Wind direction and speed

Wind direction, means the direction from which it is blowing .It has two significant effects in building designs;

1) The building orientation should in consideration of the prevailing wind. By doing so, as wind load is a lateral pressure (load), on a building which is applied on the surface of the wall of the building in the direction of the prevailing wind, the side of the building exposed to such wind will be designed to resist the wind load. It is known that, wind have load effect and are resisted by the wall systems not the beam and column system.
2) The other important thing regarding the wind direction is its contribution to the cooling effect of the wind. If the buildings opening are in the direction of the prevailing wind that origins from water body and is cool, it will moderate the room temperature of the building. This is the case of tropical areas. In case of frigid areas the vice versa to true.

On the other hand wind speed is important factor, in case of high speed winds especially if much area of the building wall surface area is exposed to this prevailing high speed wind .the structure of the building should be oriented and designed considering such effect of the wind speed. Thus knowing about the maximum prevailed wind speed of the project site is important for designing the building o be strong enough against the wind power. The higher the wind speed the stronger enough the building wall should be.

2.6.3Topography

To start from the definition "Topography is a detailed map of the surface features of land, including mountains, hills, creeks, and other bumps and lumps on particular hunk of the earth "(www. Vocabulary.com)

Topography affects building designs in three ways (Sarieh Zareaian, 2013)

a) Architectural effect

The effect of topography where the buildings are to be constructed have more effect on aesthetics than on stability. As topography is a surface feature, it has more effect on the super structure, which is related to aesthetics than the foundation which is related to more to stability. A building constructed in V- shape valley and the one on plain topography or plateau of a mountain will not have the same aesthetics,

But this does not mean that, buildings are not to be done on valley area, but, it is to say that its topography should be duly considered in order to better the aesthetics of the building. At the

same time, a building designed at the top of the plateau of the mountain should properly fit that topography to better the aesthetics

b) Structural effect

The structural effect of topography is of great concern when it is to be founded in sloppy area, where bulk excavation to level the foundation is mandatory. In this case, there will be a lateral earth pressure, in which the soil exerts pressure in the horizontal direction. Hence, in this case the effective stress which is a stress of the combined effect of the total stress and pore water pressure have great effect to the stability of the structure. Therefore, in these topography of passive earth pressure which are against the vertical structures will push the soil horizontally and finally may result in sliding or over turning of the building.

c) Cost effect

The cost effect of topography is related to the remedial solution to stabilize the structure of the building. The area of the surface of the foundation which is cut need to be will retained and also be provided with structure that enables for the dissipation of the pore water pressure, which are really costly. At the same time, fill sect of the foundation side should be well supported by a well-designed structural retaining wall, may be as costly as reinforced shear wall.

These are not the only costs, these are just structural stabilizing costs. Other additional costs, like excessive excavation to level the topography, cart away (if the excavated material is not good back fill material) and also producing and transporting borrow fill material from outside the site are additional costs, compared to a building built in plan topography.

2.6.4 Construction Input Resources

Resources of building construction are the important inputs for the realization of given project.

Resources include material, labour, equipment and finances

Material inputs.

Building material inputs are those physical materials used for building construction. These materials have great effect in the construction process of buildings in the following ways

1. Availability

- Materials to be used for construction of buildings should be available both in quantity and quality at a reasonable distance from the site of construction. A good building design with good description of material but with none of the materials at a reasonable distance is worthless

2. Cost of material

The cost of materials is the other important parameter to be considered by designs while designing buildings. It is the material cost that takes the lion share than the equipment, labour or transport cost.

Costs are not only the purchase costs, but also life cycle costs. Life cycle costs include maintenance, replacement, demolition and disposal. Maintenance cost considerations must also factor in additional environmental costs such as the emission of volatile organic compounds when repainting.

Transport cost

The type of material that should be considered in designing buildings should not be bulky with higher transport cost, instead if not a mandatory design requirement case, should be light in their weight, which ultimately will have lower transport, loading and unloading costs

2.6.5 Location of the project

The location of the building to be constructed is one of the most important factor to be considered in the design process.

As per Website, “the location of a building affects as other factors such as security, accessibility, and energy consumption, as well as energy consumed by transportation needs of occupants for communicating, the impact on the local ecosystems, and the use /reuse of existing structures and infra-structure”.

The location of a project in general is of great concern for a design person as everything of the building is dependent on the location. Location of the building other than physical factors

like soil type topography, and ground water level, highly affects the sustainability of the building design as result of micro climatic and eco region of the specific site the building is located.

Location of a building does not only affect the structure of the building, but it also affects the nearby environment. Buildings that are designed in open free space and those in the heart of the urban center will not be the same.

There are cases where it is only pile foundation that is the only foundation type to be recommended, as deep excavation for other forms of foundation may be impossible due to an existing buildings, whose foundation will be liable for collapse, due to the nearby excavation.

The other important effect of the location of a building as a design parameter is its direct effect on the height of the building to be built. Obviously, every country in general and each urban center in particular have rules and regulations as to the height of buildings to be built in given area, for aesthetic, ventilation or safety reasons. As an instance in our country, the buildings to be built in Bole international airport area are limited in their height as per the Addis Ababa city Administration regulation. This is mainly because of the interference of high rise buildings in the smooth communication between the air traffic controllers, and the pilots, and also for safety from the high wave generated at the time of landing and takeoff time of the Airplanes.

In the other scenarios, the location of the building also determines the typical of the buildings both in quality of materials and minimum built up area requirement. Accordingly, location of the building, as it has many impacts, is an important input for designing of building

Seismic and lateral earth pressure, which affects the design of a building are the results of location of a building. Hence, seismic design maps for different location are developed on the basis of earth quake hazard information records. As an instance

- The 2012/09/06 international building code
- The 2010/05ASCEtypical
- The 2009 /03 NEHRP Recommended seismic provisions
- The 2009 AASHTO Guide specification for CRFD seismic bridge design are some typical and codes that are used by professional designers as an input to their design on the basis of the location of the specific building/structure to be built.

In usual cases, earth pressure is observed on ground water found just below and side of the building. It analyzed in the geotechnical report. Its effect is purely vertical uplift effect. But, in areas where a building is located on the inclined slope of a mountain, where there is a high degree of bulk cut, there appears not only an uplift from the bottom but lateral pressure from the side which tries to push or slide the building foundation sideways. As per other explanation, the magnitude of lateral earth pressure depends on shear strength characteristics of soil, lateral strain condition. Pore water pressure, state of equilibrium soil and wall and ground surface shape of the specific location**.**

CHAPTER THREE

3.1 The Implementation frame work of university projects in general

The Ethiopian ministry of Education as a strategy to increase the number of universities in the country has launched the second generation 13 universities in early 1998 E.C/2005 G.C/.The

financer for the Projects was the German Government through its own German based company which perates in Ethiopia for decades of years.

Though the Ministry of Education has the ambition to expand and built new Universities it does not have the necessary enough qualified and experienced manpower to administer and implement the contract. The government has established a University Capacity Building Program, which is regulated by Ministry of Education (MoE) and Ministry of Capacity Building, for the new institutions being built across the country.

The MoE hired the Germen Technical Cooperation International Service (GTZ IS) in 2005 as an implementing agent for the 13 low cost projects. GTZ IS is responsible for providing on job training for local contractors, together with managing and overseeing implementation projects. Thus GTZ IS , the German company took all burden of the ministry to nominate and negotiate with the contractors, sign the contract agreement, administer the contract with MH consulting and also supply of materials to the project sites.MH consulting Engineers was nominated to design the university projects and accordingly supervise the actual execution of the projects.

Thus, GTZ IS was in full charge as owner, totally replacing the Ministry of Education, to the extent of effecting payments and supplying the necessary construction inputs that are to be supplied by the owner to the contractor.

3.2The Procurement Process of the University Projects

Procurement which is as an important step in project implementation process, is done for the University projects on an invitation basis. The party in charge of procuring Contractors on behalf of the Ministry of Education is GTZ IS. The method of procurement that GTZ IS applied was to call those domestic contractors from Grade GC/BC 4 and above. Those all interested after being invited through their Association- Contractor's association, took the bill of quantity for the respective sites they are interested. Then they will submit the priced bill description to GTZ IS and negotiate.

But, what GTZ IS has done was, they already have the unit rate and priced bill of quantity prepared by MH Consulting Engineers, which is used as a reference and Engineering estimation for the projects. As per the data from the interview ,the basic problem behind the cost estimation of MH Engineering was, as the designs for all the universities was all the same ,the overhead margin of all the projects was almost the same with only a difference of some factor of multiplication which doesn't consider the actual prevailing situation of the specific Site. Thus,

the estimation of MH consulting Engineers was not reasonable as per the information from those contractors who are assigned to Mizan-Tepi University construction projects.

MH Consulting Engineers in addition to designing and preparing cost estimation of all the University projects, were in charge of supervising the construction projects .They were fully in charge of supervising and controlling the time ,cost as well as quality of projects

Hence, Ones GTZ IS collected the financial proposal of the Contractors, then they compares each of the unit prices fixed by the Contractor against the Engineering estimation prepared by the consultant. Then after, what GTZ IS has done was ,for those items of work in which the contractor offers less cost than what the MH consulting has fixed , they automatically accept, but for those in which contractors rates are greater than the Consultants unit rate, then the contractor will be send to negotiate with the Consultant . From all the Contractors, which were 70 in total, none of them has succeeded the negotiation to convince the unit rate difference between them and the Consultant, what so ever convincing cost break down they come up with. Then the Contractor should decide either to accept the unit rate and sign the Contract or just to withdraw from the process.

Two things had happened,

1) Those with enough project at hand automatically rejected the offer, and refused to sign until and unless the unit rates are adjusted as per their cost break down
2) Those others who do not have option/who do not have project at hand, decided to sign, which was a grave mistake committed by most contractors that much contributed to their final failure of Contractors

From the data, out of the total 70 contractors which were in charge of the building the 13 University construction projects, it was only 32 Contractors who succeeded to complete the projects, while the remaining 38 Contractors ends up in termination. It means the procurement system followed resulted in more than fifty percent failure.

The procurement method was chosen for two basic reasons

1) To give a fair share of projects to different Contractors and build the capacity of Contractors from the middle to the higher grade. As is mentioned above, it was those from GC/BC grade 4 and above that were invited .Hence projects were divided in to

different volume depending on the grade of the Contractors. Those with higher grade will take projects with high volume and project cost, and vice versa. But the completion period of all the contracts was all equal -365 calendar days.

2) To build constructions by low cost house by building the management capacity of the Contractors. It was planned for Contractors to have an internationally recognized and accepted way of managing projects. Though few in number, there are of course some who got an ISO certificate for their management of their projects. Intensive training was given for those contractors who signed the contract by highly qualified professional Engineers, including Doctors and those professionals who have year's old experience in practical construction management. The training was regarding the different Scheduling systems like MS project scheduling .and the different methods of controlling project performance, as well as the different forms and formats used for reporting project related data.

But it was unfortunate that, though Contractors are benefited from the training and got some practical experience in applying in their management, most of them have bad memories that remained in their mind regarding the final fate of the contract.

3.3) The Role of GTZ IS in MTU construction project Contract Administration (Construction Phase)

GTZ IS **w**hich is the Germen Technical Cooperation International Service, have contributed much to the construction industry for our Country. The concept of low cost construction is introduced through this German international service. The currently flourishing Condominium low cost construction was the idea of GTZ IS. Before it was given to Contractors in 1996 E.C, it was this organization that first built low cost condominiums in Addis Ababa, specifically in Gulele sub city. It is after this condominium building encouraging result that, this organization further developed, and discussed the case with the Ministry of Education for the application of low cost construction approach for projects, and arranged finance from the German Government.

As per the data collected, the intention was good, but has drawbacks in that,

1) The application of typical design for all the 13 Universities which are located in different areas with different climatic condition, that needs great consideration for heating, ventilation and air conditioning system as the specific location requires, is totally ignored.

At the same time, the subsoil condition which is of great concern and which alter become the source of s dispute, was totally left aside and the foundation design were all the same

2) Considering only the typical ness of the designs, the same completion period was allocated for all. Leaving alone the others, the completion period for Mizan and Tepi projects should not have been the same, as long as many parameters are not the similar, but are highly different.

Typical designs better works as long as two different areas have the same design parameter, otherwise the pros scores higher than the cons.

In general GTZ IS has accomplished the following two tasks being in place of the Ministry of Education

1) As an Administrative body

GTZ IS as a delegate has positively contributed to the smooth construction process of Mizan - Tepi University projects in the administering projects by ways of;

- **The arrangement of percentage interim payments.**

  Though the condition of the Contract itself was good regarding the payment terms, as it allows a monthly bill, the other important strategy introduced by GTZ IS was the approval and subsequent effecting of interim payments without preparing take off sheet , which saves the time that the Consultant Engineer needs to take measurement ,prepare take off and certificate of measurement . Hence, up to a certain reasonable volume of work, the work executed by the contractor is calculated as percentile and be paid for the contractor, until and unless it reaches to a certain reasonable percent of the contract volume. This approach of effecting payment has contributed much to the contractor in saving time that is unnecessarily lost on the hand oh MH consultant for an irrelevant but personal interest reason.

- **The Introduction of pre-finance system.**

  GTZ IS was really keeping its words that it has stated from the very inception of the launching of these projects. This organization observed that, the other basic problem behind the progress of construction projects is, the financial limitation of the contractor. Then, GTZ IS designed the pre finance strategy as a remedial solution. This strategy, though finally contributed much to the progress of the project, was totally opposed by the

consultant as it was not substantiated by the contract condition provision. Hence, this strategy was fully administered by GTZ IS with no involvement of the consultant at all. GTZ IS designed this strategy after due discussion verbal agreement with contractor as a result of the delay of the projects far more than the intended completion period. As described above this approach is not included in the special condition of contract, as well as not supported in PPA 2011, but was considered as way out both by the contractor and GTZ IS. The finance paid by check to the Contractor by pre finance means is not deducted and shown in the deduction column of the payment certificate, instead it is deducted by the other means GTZ IS has designed in its finance system, after payment is approved by the consultant .That is why it is said that, the consultant has no any involvement regarding the pre finance strategy implementation. The approach is, the contractor submits a sound and an acceptable material delivery schedule for industrial materials to GTZ IS, then it will be evaluated and accordingly revised, and the contractor is informed to bring for Performa of the materials. Then, Cheque of the corresponding amount prepared in the name of the supplier is given to the contractor, and then the contractor transports and accordingly install. Before it is installed, the material supplied is checked for its quality and quantity ones after the material is delivered to the contractor's store. Then the amount paid for the contractor is deducted from the payment

- **The strategy of proportionate deduction**

  The consultant was in challenge of deducting for total cost of cement that is supplied ,irrespective of whether the contractor has used the cement or not. As the supply of cement was excess in most cases, the contractor cannot use all the cement supplied, instead there is always cement not used in the store. Hence GTZ IS, analyzing the effect of deducting the total cost of cement in the next interim payment, applied the proportionate deduction of cement that is used for the work. This approach has helped the Contractor in building the financial capacity and its subsequent contribution to the progress of the project.

B) As a supplier of Materials

Besides the role of administrative responsibilities, GTZ IS has great contribution in supplying construction in puts to the Contractor as stated in the contract.

The materials that were supplied by the owner as per the agreement were Cement and Reinforcement bars. The other supply on the side of the owner is a utility supply which is electric power. Thus, all the Contractors were supplied with three phase electric power.

-Cement Supply-The supply of cement to the contractor was agreed to be supplied on a certain fixed cost for the contractor but the cost to load from university master store , transport and unload to the contractor store are the contractor's own cost which are not considered. These costs though frequently requested by the contractor for reimbursement are totally rejected by the Consultant. This was one problem regarding the supply of cement. The supply of cement can be said that, it was surplus than shortage,though this was later the basic problem of the contractor. This was because of the temperature and humid nature of both Mizan and Teppi sites, which have great contribution for the health of cement. Cement as stored long in stores and as the environment is humid and the temperature fluctuates, and if both are not controlled, cement will highly lose its bonding property. This was the problem of the contractor that put him in problem and dispute with the consultant.

The worst case regarding the supply of cement was by the time where all the Contractors are forced to take 1500 quintal of cement without their requisition. This was done by GTZ IS/probably the only noted problem /.This was done because the big Cement factory which was under construction _Dangote cement factory was on the way to start its cement supply to the market at a least cost than the Mugher cement. Hence, as GTZ IShas paid the cost for all the cement necessary for the universities in advance, Mugher refused to refund for the remaining balance, but to supply the cement as agreed. This requisition of GTZ IS for refunding of the remaining balance, was to buy at a cheaper price from Dangote. Then, immediately after the refunding requisition is rejected by Mugher, they immediately start to transport all the remaining cement and distribute to each Contractor up to 1500 quintal. Otherwise, as long as the Contractor has an option to buy at a cheaper price, there is no binding agreement for the necessarily supply of cement by GTZ IS. Hence ,had the cement not been supplied before the start of Dangote factory ,the contractor could have refused the supply ,and would have bought at cheaper price directly from Dangote cement factory, which was a mess for GTZ IS. It was not more than 500 quintal out of the 1500 quintal that was used by the time contractors when terminated. The solidified and consolidated cement is still in the store of terminated contractor's store, which was a mess not only for the contractor but also our country at large.

-Reinforcement Supply-The supply of reinforcement was smooth and was not a point of dispute, as the contract itself was labor contract.

-Supply of Utility/Electricity-This case was appoint of conflict as the project was delayed due to the interruption of power. But finally solved, as GTZ IS orders contractors to buy Generator for the cost to be recovered**.**

3.4 MH Consulting Engineers typical design and their effects in Contract administration (construction Phase)

As is described in the literature review, typical designs have advantages like,ease of implementation ,controlling budget and easy of contract administration. This actually works where typical designs are implemented in areas with similar design considerations.

Asper the data collected,the application of typical designs was the basic problem and the root cause for the challenges in the Contract administration. The basic problem behind these typical designs is not only the ignorance of design parameters of each specific site, but also the respective poor cost estimation of each site by the consultant. As Mizan-Tepi is not specifically studied for design parameters, thus was problematic to reconcile what is depicted in the drawing and what is actually on the ground. Any time or cost claim of the Contractor is related to the incomplete design or varying site condition, a mistake which is directed to the Consultant. Hence, the consultant to make itself on the safe side,always squeezes the contractor's claims. They want to offset their major design weakness by the contractor's minor problem.

Contractor's positive comment regarding the omitted but the crucial and necessary heating, ventilation and air conditioning proposals were viewed as simple blame of the contractor over the consultant on the side of the consultant.

Major design related problems

1) **Openings**

Openings are provisions in buildings used as means for lighting and ventilation. The size and number of openings depends on the specific prevailing climatic condition. But irrespective of their difference in climate elements that deserves to be considered in the design process, it was all the same for Mizan and Teppi construction projects. As per the data collected, the opening consideration is relatively convenient for Teppi than Mizan.In Mizan there were louver doors which were installed and then which are demolished and

replaced by solid walls due to the complain of users/students/. Similarly there were openings in dormitory buildings in Mizan which are prefabricated ventilation provisions, but altered to solid walls due to the humid wind

Table 1-a table that show the average and range of temperature as well as precipitation of mizan and Teppi town for three years (2014-2016)

Item	Name of town	Average temperature	Range of temperature	Average precipitation	Range of precipitation
1	MizanTeferi	(19.6°C)	2.9°C	(1574.8 mm)	160mm
2	Teppi	(21.6°C)	3°C	(1524 mm)	177.8mm

AS can be seen above in the table ,the temperature and precipitation of Miazn and Teppi town differs ,signifying that the design should accordingly differ .Hence ,the three years average temperature for the year in Teppi is 70.9°F (21.6°C). while the range of temperature is 3°C(The highest being 23.3 and the lowest 20.3)/ On the other hand ,The three years average amount of precipitation for the year in Teppi is 60.0" (1524 mm). While the range of precipitation is 177.8mm (the highest being 210.8 and the lowest 33mm)

On the other hand ,the three year average temperature for the year in MizanTeferi is 67.3°F (19.6°C),while the range of temperature is 2.9°C.(the highest being 70.3°F (21.3°C)while the lowest is 65.1°F (18.4°C) .On the other hand ,the three years average amount of precipitation for the year in MizanTeferi is 62.0" (1574.8 mm),while the range of precipitation is 160mm(the highest being 203.2 mm and the lowest 43.2 mm) The month with the most precipitation on average is August with 8.0" (203.2 mm) of precipitation.

1) Ventilation and Air conditioner

These two design consideration are not to be overviewed for a building to be user friendly and comfortable for the intended end users. There are codes and standards as to the consideration of these provisions .But, these were totally ignored in these university designs, which the contractors had been strongly commenting to be included in the design, while the consultant was strongly arguing for its absence .It is practically impossible to work in administrative and class room buildings in Teppi on January, February and April where the temperature is really high in

rooms with no ventilation provision. Ventilations are lately done by small enterprises with a separate contract agreement, which incurred high cost of rework and time.

3) Foundation Designs

The analysis of the data also shows that, the design for all the Universities including those of Mizan and Tepi was typical from the sub to super structure with no difference at all. This was the grave mistake that the Consultant has committed and the owner has accepted. It was this cause that first ignites problem between the consultant and the contractor.

Due to this problem, the Contractor has suffered a lot than the other, and can be said that, it was the primary victim next to the Employer. The following were the major problems

1)As the design and what is actually is there on the ground was not the same, it was mandatory for the design to be revised, which needs time .But the Contractor has already mobilized the necessary manpower and Equipment ,which should still wait idle till the design is revised. Though the Contractor claims for prolongation cost, the Consultant rejected in gross. Even though ,the contractor has the mandate to immediately reject the Consultants decision, it was assumed not fair by the Contractor ,to start the project in dispute, before starting even the very site clearing work. This was the golden opportunity for substantive claim, but was miscalculated by the Contractor. Hence, the prolongation cost for idle machinery and manpower was totally absorbed by the contractor, with only time extension compensation.

2) There were some modifications that came from the consultant side due to the pressure on other similar university projects, which the consultant was forced to consider and also those included in the design due to its incompleteness. These modification orders though really important for the building were not timely. These untimely variation work orders forced the contractor for unnecessary rework that consumes much time than what the new activity consumes. There are no time extension compensation for the contractor, as refused by the consultant reasoning out that, the activities are not in the critical path to affect the completion period.

Due to the above two problems that the contractor has faced, the Contractor was always blaming the Consultant for untimely modification work orders in every monthly regular project meeting of the Consultant, GTZ IS and the Contractor himself. These modifications were really good had it included the major design problems like heating, Ventilation and Air Conditioning, which are insignificant for end users.

This situation lead to a bad relation between the Contractor and the consultant, which later contributed to the delay and ultimate forced termination of the Project.

3.5 Typical designs as the cause for termination of projects

The goal of any construction project plan is to be completed as designed with the intended completion period and give the necessary service for the targeted end user society. In similar manner, the 13 University projects were planned to be completed within two years including furnishing and staff recruitment, and to start to accept students in the beginning of the Millennium and accordingly in the next subsequent years. But, though partially possible, was not possible as planned. This was due to the delay followed by termination of projects.

As per the data, there notable reasons for the termination of projects

1) The forced withdrawal of GTZ IS from building construction projects

GTZ IS was acting in place of the Ministry of Education shouldering tasks from signing Contracts with the Contractor supplying materials, effecting payments and administering the projects. GTZ IS has tried the very best to the keep the word they speak in public during the training of the Contractors who signed the Contract. They have tried to build the financial capacity of the Contractor by pre financing strategy and easy way of payment processing .At same time ,they realize the difficult climatic environment of Mizan and Teppi for construction ,and also clearly knowing the problem behind the Consultant ,were on the side of the contractor and if necessary rejects the unfair decision of the Consultant.

But for reason not clear enough, ministry of Education terminated the contract with GTZ IS for its involvement in building projects, and was limited to infra structure projects. This was a bad news for the Contractor. Then, in place of GTZ IS the Mizan-Teppi University was assigned in place. This time on, the Contractor was in full autocratic way of administration by the Consultant ,no one being in between like before to compromise issues between the Contractor and the Consultant. The already existing poor relation worsened and lead to the hopeless decision of some Contractor to abandon the site.

2) Before the withdrawal of GTZ IS, the deduction system for the supplied cement was ,only the amount used ,leaving the un used amount in store. As is noted in the other section,the cement supply to the Contractors was not as per the schedule. The 1500 quintal cement supplied for a reason mentioned in the other section of this research

paper,was the one that can be noted .Hence ,the contractor should not be liable for the un used cement in store, thus should not be deducted from the payment due to the Contractor. This was the logic and the practical approach of GTZ IS. After this organization was terminated, then the Consultant exploited the gap and manipulated the MTU new administrator in charge that,deducting all the cement supplied to the Contractors is the proper contract administration way ,and thus was done as planned. All the cement supplied to the contractors was deducted in total from their payment, all the contractors instead of getting payment were in debt, expected to pat back from their account. This case concluded the total freeze of the MTU projects. None out the total of five contractors were on site, all abandoned the site, and then the cement which amounts to 1000 quintal in contractor's store, stored for years and dumped after years.

3) The Contract agreement has a price adjustment provision, accordingly the materials price index, which is used as base price reference for price adjustment, was part of the contract document for all the materials including the local materials. Regarding, the MTU case, considering the sand as an instance to show the problem related to base price of materials is suffice. The cost of sand in Mizan by the time Contractors were taking over the site was 4500/14$m^{3,}$ though what is stated in the contract document as base price was 2500/14m^3. This was promptly informed to the Consultant to adjust the cost of sand and accordingly revise the cost of concrete, but it was almost after months that, the cost of sand was adjusted to 3000/14m^3, which is yet not reasonable.

After a year and half from the contract, the actual cost of sand in Mizan was within the range of 12,000/14m^3 to 14,000/14m^3 birr. But the consultant did not adjust the cost of sand and the corresponding adjustment for the unit rate of concrete for the following reasons

A) Though ,the contractor buys sand at ,say 12,000 birr in Mizan on free market basis ,he cannot produce a receipt that substantiate the cost ,as the suppliers are just those individuals with dump truck but with no legal license and receipt.

B) The Contractor buys the sand at a cost of 1200/14m^3 from the source / Dima rural town, found in Gambela national regional state/ ,which is only 120 KM, the road is a very difficult gravel road ,with high wear and tear of the truck especially the tire. Thus it takes two days and even three days in some cases /in the rainy season/ for one round trip. As per the information, it was a must to replace the whole tire of the truck in a month and

half, which is expected to service a minimum of six months in other areas. The hot temperature, in addition to the difficult gravel road was the other additional reason for the high wear and tear of the truck and the tire. But, the Consultant even though knows all these facts, could not consider and adjust the price of the sand.

C) The other that contribute to the cost escalation of sand was, the Fuel case. Fuel was almost bought in black market, though contractor was allowed only 800 liter of Nafta per month upon the Supporting letter written from the University and the Zone administration .But ,this was only a quarter of the monthly demand ,the remaining being bought in black market at a higher price than what is in the fuel stations. Once again, it was difficult for the contractor to produce relevant receipt, which makes the price adjustment requisition difficult.

5) The swift withdrawal of GTZ IS from the administration.

This was the other important factor that created gap in the fore coming operation of the MTU administration in place of GTZ IS. Hence, there was great vacuem created as GTZ IS leaves with no document or site hand over. The MTU administration just collected the document what is already was in their office, with no physical briefing regarding the history of each Contractor. Hence, everything of the Consultant decision is implemented on the MTU side, including withholding payments of contractors, as they have no enough knowledge of the Contractors history to refuse. Hence, the projects which were in sluggish progress now further progressed to total abandonment of the projects.

In general, the Consultant to cover the problems that they committed in the design period as a result of typical designs, was finally successful in terminating the projects throwing all the default totally to the Contractor.

3.6 Residual effects of Typical Designs on end users

After passing the different problems mentioned in the construction process, the projects were completed by different means, some still under construction by other contractors. But MTU was suffering much to resolve the residual effects of the terminated projects as a result of typical design related problems. The following were the major effects

1) Additional cost – the time when the contractors were terminated, which is early 2000 E.C was the time where the cost of cement and reinforcement was peak, then those

Contractors offer for the remaining work of the buildings was almost equal to the first contract price. This additional price was totally absorbed by Mizan –Teppi University, as the way the projects terminated was not in proper procedure to claim the additional cost.

2) The University was not in a position to accept students as planed in the beginning, where the project was first launched /1998 E.C/.Thus the effect was not only a question of accepting the planned number of students,but the limited accepted students themselves were in inconvenient situation, attending class in incomplete buildings and residing in partially if not poorly finished buildings. The same was in case of lecture halls and administrative buildings. The temporary built dry latrines, beyond the unplanned cost incurred were so bad, as it smells from a distance.
3) Additional cost for modification for Acclimatizing-as the design was typical for both Mizan and Teppi, being with different prevailing climate, it was a must to invest for modifying the opening and accordingly acclimatize the buildings to be user friendly and comfortable for the University society. Hence, a lot is invested on heating, Ventilation and air conditioning to acclimatize the buildings.

It is important to suggest opinion regarding the implemented design in Mizan and Teppi campus building projects .Leaving all the other Universities which have the same design like MTU,Mizan and Teppi towns which are at distance of only fifty kilometers apart have different prevailing conditions that contributes to the design of the buildings.

Thus, the implemented design was altered for user's convenience and comfort, it is not as good as the one that could have been done harmoniously, the design being totally adapted for specific to Mizan and Teppi from its very start of the construction phase. As per the data ,the topography of Teppi is relatively plain ,while that of Mizan is with ups downs with no flat area as big as a football field .Hence ,it was better had the designs of Mizan considers the basement advantage ,instead of high bulk excavation ,retaining wall and excessive backfill .Meaning instead of backfilling ,it was possible to get one basement floor area with almost no or very little additional cost. Some building have a retaining wall ,some concrete shear and some others stone masonry wall, as high as wall height of a building .The building of solid walls in place of openings due to the prevailing cold wind in Mizan is better for comfort than before ,but resulted in poor aesthetics

Regarding, Teppi campus, the suggestion is more directed to openings .In relation to the prevailing daily temperature of the autumn and winter season .there should have been an Air Conditioning provision in class rooms, cafeteria and multipurpose hall buildings. An attempt to alter for an additional openings did not result in significant effect than its negative contribution for its aesthetics.

Chapter Four

Conclusion and Recommendation

4.1 Conclusion

This short research paper has investigated the effects of typical design in the construction phase taking Mizan Tepi University as an instance case. From the findings of the research it is possible to conclude that typical designs, though have an advantage in easing supervision and minimizing the supervision cost, simple to control and monitor project budget, are disadvantageous, if not properly and carefully handled. The design consideration of all the cases being the same, ignoring the specific prevailing actual site conditions highly matters the construction process. Assigning similar completion duration, without considering the availability and the distance of resources from the specific site have resulted in delay of the project, which the contractor should not have been liable, as it is impractical to achieve from its very beginning. Mizan and Tepi Campuses, though are located at a distance of 50 KM from each other, have differences to be considered to set and determine the completion period.

Additional cost and time extension claims by the contractor which are the result of typical design effects are, which usually are resisted and rejected by the consultant, leads to the delay and

dispute between the Contractor and the Consultant. This case ignited bad relationship between the Consultant and the contractor ,which further worsened, when GTZ IS - the party acting in place of the Ministry of Education , was terminated from building Construction projects .The Swift withdrawal of GTZ IS ,without proper handing over of documents to the MTU administration who replaced them and without solving pending cases of contractors ,resulted in total mess of the projects. The assignment of MTU in place of GTZ IS with no knowledge of the projects and no experience and qualification in the field of construction, made MTU tooth less lion with no power to exercise and with no idea to suggest. This was clearly expressed, when the consultant proposal for the deduction of all the cement which is supplied to the contractor without the requisition and schedule, accepted and accordingly the payment of the Contractors is withheld by MTU. It was at this time that, almost all the Contractors decide to abandon their site, as they do not have the financial capacity to further proceed.Aggrieved relation between the Contracting parties, distorted the proper implementation of the Condition of Contract, including the requisitions of contractors for price adjustment, cost and time extension claims. The usual refusal of the contractor's requisition by the consultant is to associate that, the cause for the delays and other problems is not due to the typical design consequences, but the poor performance of the contractor. This overall case resulted in the additional cost of MTU for modification to acclimatize and to finish the terminated projects at an escalated price, the bad history of termination and loss of properties of the contractors, and poor implementation result on the strategic plan of the Ministry of Education at large.

4.2 Recommendation

On the basis of the finding of the research the following remedial solutions are stated.

1) The typical designs should be developed for each sub soil condition and for each climatic zones. Meaning, usually there are four major types of subsoil condition in our country named as clay, soft rock, hard rock and black cotton soil. Hence, ones typical designs for these sub soil types are developed, then the contractor will negotiate unit rates for all types of the foundations. Then the contractor, will immediately proceed to his work on the basis of the design that is prepared for either of the sub soil types that he faced, with no time elapsing for design revision , and claim for additional cost and extension of time. This actually works for simple and low rise buildings the same will be done for the super structure. That is, Super structure designs will be designed for Dega, Woinadega and Kolla climatic zones, then the contractor will do the same like he has done for

foundation. This approach of modified typical designs will solve the hassle of claims that arises.

2) The condition of contract especially, the completion period should consider the specific location, the access condition and the availability and distance of resources from the given site and accordingly set the right and logical completion duration as, to minimize time extension claim and the resulting disputes.
3) The condition of contact should be fair for all contracting parties and not be one sided contact. The Contractor should also refuse to side an unfair, biased and one sided contract.
4) The estimation of unit rates and the investigation of materials price, that are to be used as base price for price adjustment should be carefully studied and fixed. There should also be timely revision of prices whenever there are changes in cost of materials, and fair contract administration.

References

K.Ahmed. (2001). Temperature effects in multi-storied biuldings. *Journal of Engineering sciences Assuit university*, 249-267.

Mike Carter C.E.T and Roman Stangi, C. (2016, october 17). *www.wbdg.org.*

Oreszezyn, S. P. (2010, december 2). *www.google.com.* Retrieved from www.wbdg.org.

Sarieh Zareaian, K. A. (2013). The Role of climate on designing and constructing buildings (from urbanization Architecture approach. *Bulletin of environment,pharmacology and life sciences*, 197-200.

sida. (2014). *Report of fifty years partnership against poverty.* Sweden: Edita publishing.

Interview Questions

1. Was the universities of this generation design typical both in their Sub and Super structure? Taking the case of Mizan and Teppi as instance

A/ Yes B/No

If yes why for was this done, as there are no two projects that are similar in their location and the corresponding design parameters?

If no, which is their major difference from the following?

A/ Sub structure

B/Wall height and wall systems

C/Ventilation including door and window positions, sizes and orientation

D/Electrical installation systems/cooling and heating systems/

E/Any other, if any

2. What were the major effect of typical designs during the Construction implementation phase? Were there designs revisions done for the designs to better fit the specific location? How was the effect on additional cost and time extension claims? Was the Contractor compensated for prolongation cost if at all?

3. Was the Special Condition of Contract the same for all the University projects especially the completion period? If the same, was it really reasonable to be the same as the availability and the distance of the necessary resources is not the same for all the projects?

4. What was the method of procurement employed? Why was the specific method of procurement chosen?

5. There were history of termination in some of the university projects including Mizan_Tepi. What were the major design related causes? Who was the major Contracting party who is in default of the contract condition? Was the condition of Contract fair for both Contracting parties? Was the contract price reasonable in relation to the cost of materials, labour and the location of the project?

6. Were there disputes in administering contracts to the extent of Arbitration or Litigation? How was the extent of the resolution process both in time and cost effect?

7. Were there supplementary agreements signed due to the incompleteness or some irrelevant cases of the original design? If yes, what was the effect on Time and Cost? How was the method to determine the unit rate for the new activities? How the additional completion time for the supplementary work determined?

8. Mizan and Tepi have different topography, climate and sub soil condition. But the design of the buildings including the Student Dormitories, the Class rooms and Administration buildings. Is it logical from the design parameters point of view? Are buildings comfortable and user friendly now?

9.How was the effect of the design related variations between the contracting parties and the Consultant?

10. Were there residual effects of the design after taking over of the Buildings, like aclimatizing the buildings accordingly for the effect of climatic condition?

11. Was there price adjustment provision in the Contract document?

A/ Yes B/No

If the Answer is No , was there problem in completion of projects as scheduled , related to price escalation as the then and the current material market price of the construction materials including labour and Equipment rates are volatile ? If yes how the price adjustment? Was the Consultant fair in considering the new cost of materials, and accordingly adjust the unit price?

12. It is known that it was GTZ IS that was in place of the owner. How was the contribution and role of GTZ IS in administering, supplying materials/if any/ and effecting payments? What was the effect of the contract termination and subsequent withdrawal of GTZ IS from building projects affected the project progress

13. Was there some materials supplied by you/the owner/?

A/ Yes B/No

If yes, was the supply of the materials smooth? Was there effect of the supply of materials on the smooth progress of the projects? Was there a test result paper for the materials supplied to the contractor by the Owner? How was the test for Concrete was managed/ to whom to attributed to/

if some ingredients are supplied by the owner and some other by the Contractor, if in case the concrete fails on test?

14. What lessons have you learned from such type of Typical Designs and Conditions of Contract?